# BT-1022

# Class 2 CSR BC04-EXT Bluetooth Flash Module

# User Manual

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## Technical Support Contact Information

If you encounter any technical issues while using BT-1022, do not hesitate to contact us @Atech. Our technical staff will help you resolve the technical issues. You can contact us by email or phone. The following is our technical contact:

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# 1. Overview

Atech BT-1022 module is a field-proven software programmable CSR BC04 external Bluetooth v2.1+EDR module. With independent CPU and flash memory, the Bluetooth protocol stack is put on the module. The module makes adding Bluetooth connectivity easy because the host system does not need to handle the Bluetooth protocol stack.

Since all Bluetooth protocol stacks are managed by the module, Bluetooth connectivity can be easily added to devices with 8- or 16-bit processors, eliminating the need to port existing applications to a more complicated platform and resulting in fastest time to market and reduced development costs.

For users to configure and control the module from a PC or host processor, there are two options of standard firmware available.

| Firmware Option | Typical Usage |
|---|---|
| AT command interface | Micro-controller type system to create Bluetooth wireless connectivity through UART interface. |
| SPP (Serial Port Profile) | Create a wireless remote serial port over Bluetooth connectivity. |

Through the reference and usage of AT command interface or SPP firmware developers and system integrators will easily evaluate the modules and Bluetooth technology. The purpose is to make the integration of the Bluetooth technology as seamless and easy as possible for Atech customers.

This document will explain how to connect the BT-1022 module and establish Bluetooth communication with a Bluetooth enabled PC for reference. This document also describes the hardware interfaces to integrate the modules into the target system easily.

The module is also available with several different firmware options for data and audio communications other than the standard firmware. Atech also provides custom firmware services with extra NRE charge. This can eliminate customer's Bluetooth software effort and speed up the time-to-market. However, this is beyond the scope of this document. Please contact Atech sales representative for more information.

**Typical Applications**

- Asset tracking
- Measurement / Remote Equipment Monitoring
- Scanners

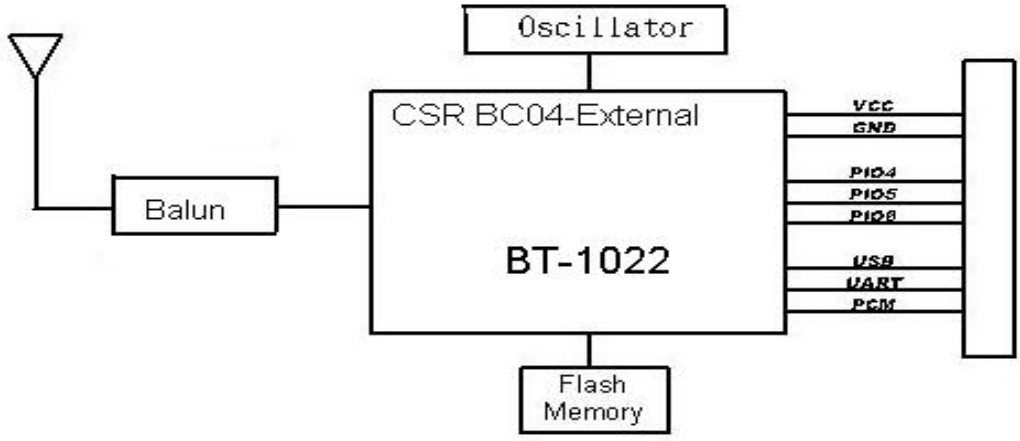
- Sensors & Controls
- Hand held terminals
- Industrial devices
- Point-of-Sale systems
- Personal Digital Assistants (PDAs)
- Automotive Diagnostics Unit

## 2. Hardware

BT-1022 is a surface-mount module designed to be integrated to a system board as a wireless subsystem or standalone system. The hardware interface is grouped into the following functional blocks:

- Power supplies: VCC line should be connected to 3.3VDC.
- GPIOs: The PIO lines can be configured as general purpose 3.3V level digital inputs or outputs.
- UART: UART_TX, UART_RX, UART_CTS and UART_RTS are UART communication interface signals. UART_CTS and UART_RTS are not necessary to be connected if hardware flow control is not used.
- USB: USB interface is used for HCI mode only.
- PCM: PCM interface is used for audio codec. Special software programming support is required.
- SPI: SPI interface can be set to master or slave. This is software programmable. Special software programming support is required.
- RF: The RF_OUT should be connected to the antenna.

**Block diagram**




## 2.1. Hardware Integration

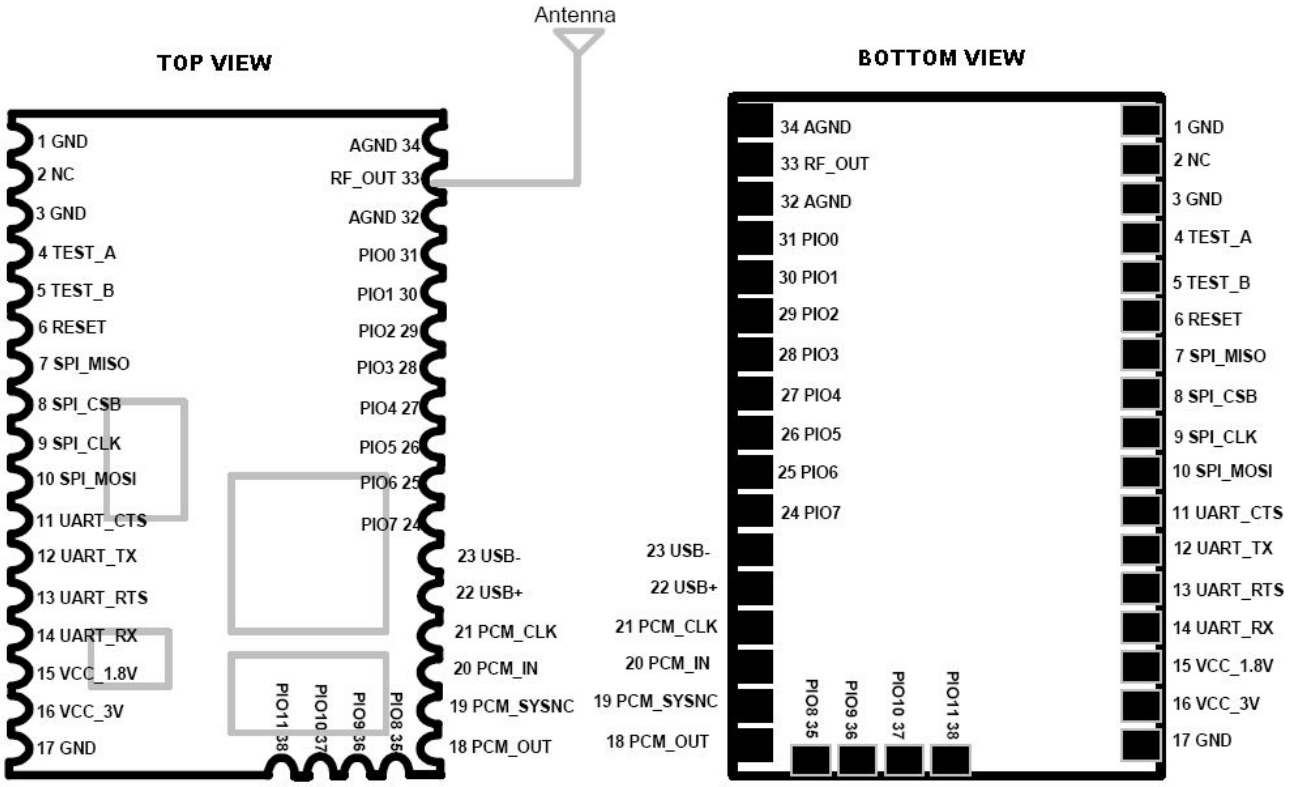
The module requires only 5 connections to power up and create a Bluetooth wireless connection. In the

simplest configuration, the hardware only needs the following connections: VCC, RF_OUT, UART-TX, UART-RX, and GND. VCC and GND pins connect to a regulated 3.3VDC power supply. The RF_OUT connects to a 2.4GHz antenna. The user connects UART-TX, UART-RX and ground pins to the host controller or a PC. The host controller or a PC can control the module and set up Bluetooth connection with the commands and settings defined in this document.

The user can also use other functional blocks like GPIO, USB, SPI and PCM interfaces. Special software support is required to use these interfaces.

## 2.2. Pin description

The following picture shows pinouts of BT-1022 from the top and bottom of the module.

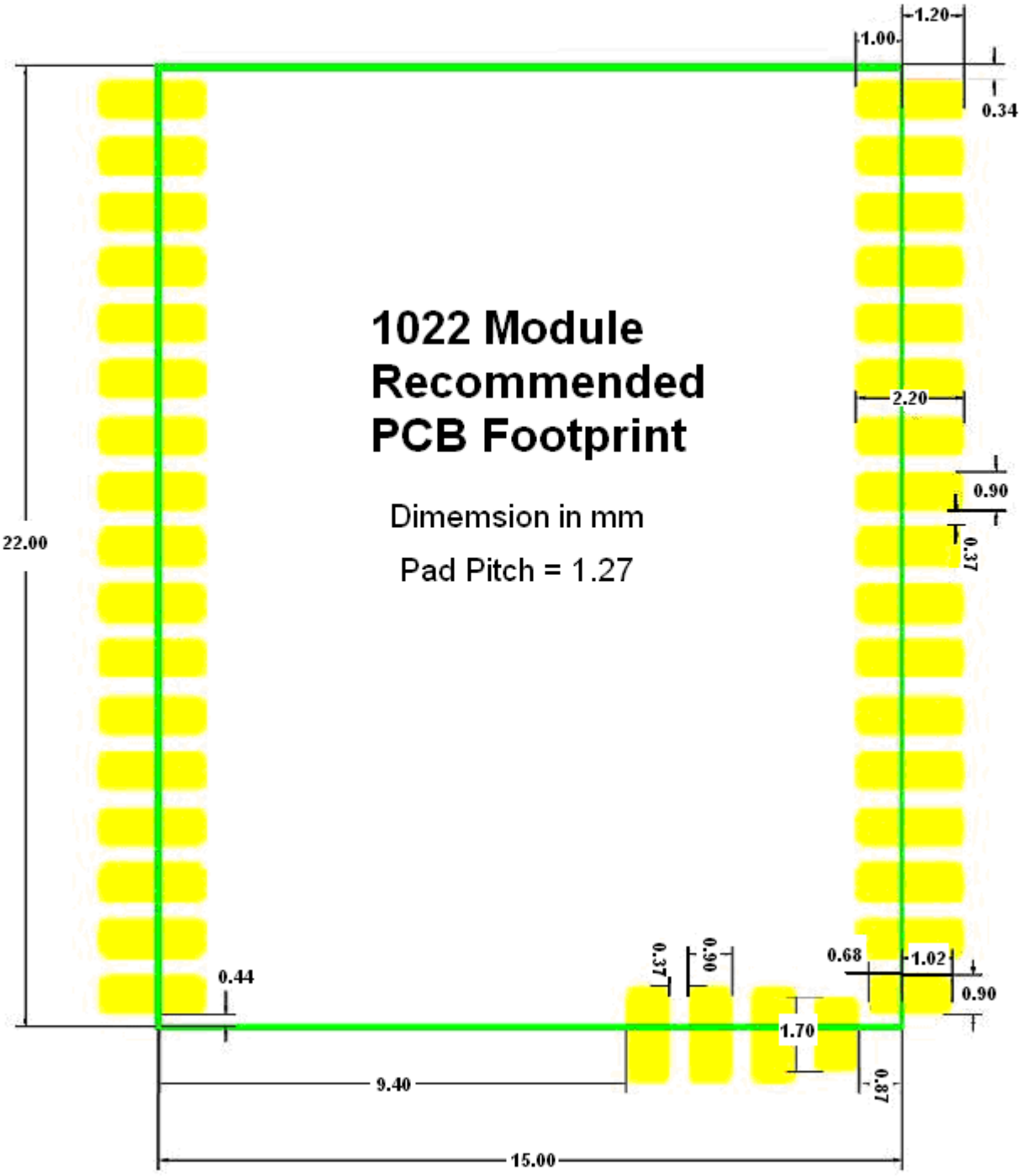



| Pin | Name | Type | Note |
|---|---|---|---|
| 1 | GND | | |
| 2 | NC | | |
| 3 | GND | | |
| 4 | TEST_A | | Internal Testing Use |
| 5 | TEST_B | | Internal Testing Use |
| 6 | RESET | In | 1. It should be pulled low for normal |

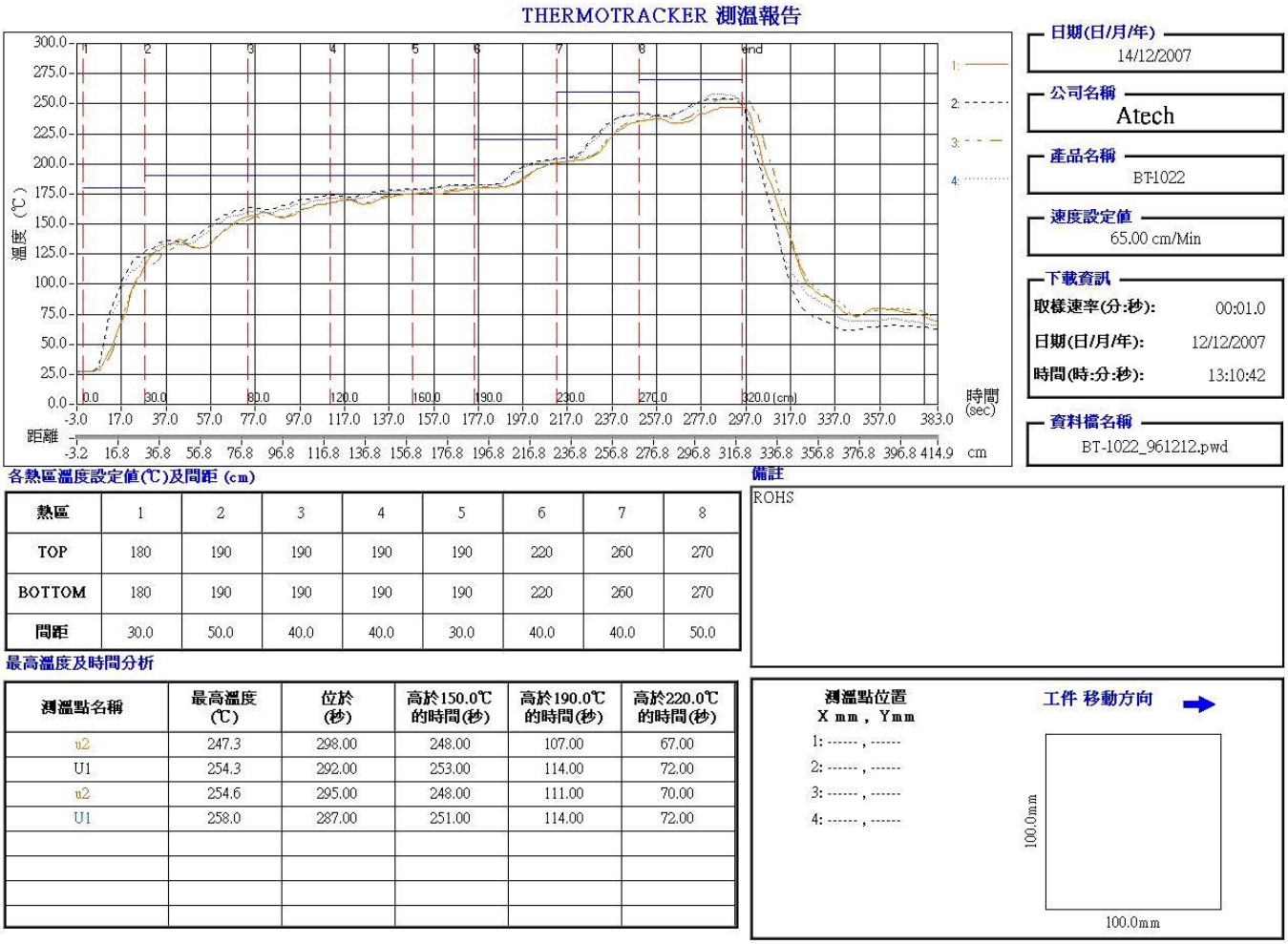
| | | | |
|---|---|---|---|
| | | | operation (Active High)<br>2. A Reset will be performed after PIN6 being active for 1.5~4.0 ms |
| 7 | SPI_MISO | In | Internal Testing Use |
| 8 | SPI_CSB | In | Internal Testing Use |
| 9 | SPI_CLK | In/Out | Internal Testing Use |
| 10 | SPI_MOSI | Out | Internal Testing Use |
| 11 | UART_CTS | In | |
| 12 | UART_TX | Out | Connect to host processor UART RX pin |
| 13 | UART_RTS | Out | |
| 14 | UART_RX | In | Connect to host processor UART TX pin |
| 15 | VCC_1.8V | Out | |
| 16 | VCC_3.3V | In | Main power supply |
| 17 | GND | | |
| 18 | PCM_OUT | Out | Codec Interface |
| 19 | PCM_SYNC | In/Out | Codec Interface |
| 20 | PCM_IN | In | Codec Interface |
| 21 | PCM_CLK | In/Out | Codec Interface |
| 22 | USB+ | In/Out | |
| 23 | USB- | In/Out | |
| 24 | PIO7 | In/Out | General Purpose I/O |
| 25 | PIO6 | In/Out | General Purpose I/O |
| 26 | PIO5 | In/Out | General Purpose I/O |
| 27 | PIO4 | In/Out | General Purpose I/O |
| 28 | PIO3 | In/Out | General Purpose I/O |
| 29 | PIO2 | In/Out | General Purpose I/O |
| 30 | PIO1 | In/Out | Internal Used |
| 31 | PIO0 | Out | Internal Used |
| 32 | AGND | | Analog GND |
| 33 | RF_OUT | | Connect to antenna |
| 34 | AGND | | Analog GND |
| 35 | PIO8 | In/Out | General Purpose I/O |
| 36 | PIO9 | In/Out | General Purpose I/O |
| 37 | PIO10 | In/Out | General Purpose I/O |
| 38 | PIO11 | In/Out | General Purpose I/O |

## 2.3. Dimensions

Use the dimensions shown in the picture below to do the PCB layout for the host system or carrier board that will use BT-1022.



## 2.4. Reflow Profile




| 熱區 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| TOP | 180 | 190 | 190 | 190 | 190 | 220 | 260 | 270 |
| BOTTOM | 180 | 190 | 190 | 190 | 190 | 220 | 260 | 270 |
| 間距 | 30.0 | 50.0 | 40.0 | 40.0 | 30.0 | 40.0 | 40.0 | 50.0 |

| 測溫點名稱 | 最高溫度 (℃) | 位於 (秒) | 高於150.0℃ 的時間(秒) | 高於190.0℃ 的時間(秒) | 高於220.0℃ 的時間(秒) |
|---|---|---|---|---|---|
| u2 | 247.3 | 298.00 | 248.00 | 107.00 | 67.00 |
| U1 | 254.3 | 292.00 | 253.00 | 114.00 | 72.00 |
| u2 | 254.6 | 295.00 | 248.00 | 111.00 | 70.00 |
| U1 | 258.0 | 287.00 | 251.00 | 114.00 | 72.00 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## 2.5. Packing and Label Information

**00190E** : Fixed Code for Atech

**XXXXXX** : 6-digit MAC numbers

Date Code : **2AYWXX** for AT Command

**2DYWXX** for SPP

(W: Manufacturing sequent Week)

(Y: Manufacturing Year 201Y)

# 3. Configuration and Operation

This section describes the basic configuration and operation for both usages –

**(1) AT Command Interface (2) SPP (Serial Port Profile)**

## 3.1. Usage - AT Command Interface

### 3.1.1. Configuration to connect to a PC

This section describes an example setup to connect a BT-1022 module to a PC for testing purpose.

1. Equipment list:

| Item | Note |
|---|---|
| PC | Windows XP O/S with a COM port |
| Power source | Regulated 3.3VDC power source |
| RS232 transceiver | BT-1022 has only TTL level UART. A RS232 transceiver is required to interface the BT-1022 UART and PC RS232 port. |
| 2.4GHz antenna | A 2.4G antenna needs to be connected to the BT1022 module. The antenna can be a 2.9mm copper wire. |
| RS232 cable | Connects PC RS232 port to the RS232 transceiver. |

2. Set up the BT-1022 hardware connection according to the following table:

| Connection | BT-1022 pin | Host system connection |
|---|---|---|
| PWR | 16 | Regulated 3.3VDC power supply |
| UART_TX | 12 | This pin goes to RS232 transceiver TTL TX input |
| UART_RX | 14 | This pin goes to RS232 transceiver TTL RX Output |
| GND | 1 | Ground |
| RF_OUT | 33 | This pin should connect to a 2.4GHz antenna |

3. Launch Hyper Terminal or Teraterm program, choose an available COM port and apply the port settings as:

| Item | Setting |
|---|---|
| Baudrate | 9600 |
| Data bits | 8 |
| Parity | None |
| Stop Bits | 1 |
| Flow control | No flow control |

You can issue AT commands to the BT-1022. When you issue AT commands, you should see the response defined in later sections coming back from the BT-1022.

### 3.1.2. Operation Modes

The BT-1022 standard firmware has 2 operation modes: **Command mode** and **Data mode**. The command mode is for the user to configure the BT-1022 module. In command mode, BT-1022 takes defined AT command set as described in later sections. The data mode is for data exchange with other connected Bluetooth devices.

When BT-1022 is powered up, the default operation mode is command mode. To enter data mode, follow instructions in "Connect Command" section (as in chapter 3.1.8 Action Commands) to connect to another Bluetooth device.

The user can use any preferred terminal program application like Teraterm, or Hyperterm to connect to the BT-1022 through COM port. Teraterm is recommended because of its popularity and user friendliness. You can go to the official Teraterm site to download the latest Teraterm application: http://en.sourceforge.jp/projects/ttssh2/releases/.

### 3.1.3. Command Reference

The command interface of BT-1022 standard firmware is a modem-like AT command set. The following sections describe syntax and commands used in command interface for the user to configure and control BT-1022.

### 3.1.4. AT Command Format

The AT command format is:

**AT<cmd><cr>** or **AT<cmd>=<value><cr>**

***** <cmd>** represents ***specified command;*** **<cr>** represents **\r**

| Format | Example | Example |
|---|---|---|
| AT+<cmd><cr> | AT + GLN \r | Host send Get local name command |
| AT+<cmd>=<value><cr> | AT + PIN = 12345678 \r | Host send Set pin code command |

### 3.1.5. AT Command Response Format

The AT command response format is:

**<cr><lf><Response Code><cr><lf>**

*** **<cr>** represents **\r**; **<lf>** represents **\n**

There are two categories of Response Code:

## Category 1 Response Code

| Example | Meaning | Condition & Notes |
|---|---|---|
| \r \n 1 \r \n | OK | |
| \r \n 2 \r \n | ERROR | ie, AT+INQ = 000000,**15**,10 \r<br>(1 <= maxResponses <= **10**) |
| \r \n 3 \r \n | UNKNOWN | ie, AT+**ABC** \r<br>(command ABC is not available) |
| \r \n 4 \r \n | FAILED | ie, command/response successfully finished; result to be no match |

## Category 2 Response Code

| Example | Meaning | Condition & Notes |
|---|---|---|
| \r \n +STA:state \r \n | **STATE:**<br>**to indicate current status** | **state:**<br>1 : sppDevReady<br>2 : sppDevInquiring<br>3 : sppDevConnecting<br>4 : sppDevConnected |
| \r \n +SM:scanMode \r \n | **SCANMODE:**<br>**to indicate current scan mode** | **scanMode:**<br>0 : hci_scan_enable_off<br>1 : hci_scan_enable_inq<br>2 : hci_scan_enable_page<br>3 : hci_scan_enable_inq_and_page |
| \r \n +INQ:address, classOfDevice \r \n | **INQUIRY result** | **address:** 12 hexadecimal<br>**classOfDevice:** 6 hexadecimal |
| \r \n +INQC \r \n | **INQUIRYCOMPLETE** | |
| \r \n +COD: classOfDevice \r \n | to indicate class of device (local device) | **classOfDevice:** 6 hexadecimal |
| \r \n +LA:address \r \n | LocalAdress | address: 12 hexadecimal |
| \r \n +LN:name \r \n | Local Name: Return code of get local name command | User friendly name of the local device |
| \r \n +SCM:securityMode \r \n | Sscuritymode: to indicate current security mode | **securityMode:**<br>0 : security_off, encyption_off<br>1 : security_on, encyption_off |

| | | |
|---|---|---|
| | | 2 : security_on, encyption_on |
| \r \n +RN:address,name \r \n | Remote Name: Return code of get remote name command | **address:** 12 hexadecimal<br>**name:** user friendly name of the remote device |
| \r \n +SSPP:address,result \r \n | SEARCHSPP : Return code of search SPP profile command | **address:** 12 hexadecimal<br>**Result:**<br>0 : SPP profile not found<br>1 : SPP profile found |
| \r \n +CD:address \r \n | CONNECTED : Indication of SPP connection | address: 12 hexadecimal |
| \r \n --- \r \n | Connected : The last result code before entering data mode | |
| \r \n +++ \r \n | Disconnected : The first result code after returning to command mode | |
| \r \n +OM:mode \r \n | OPERATIONMODE : Return code of get operation mode command | |

### 3.1.6. Set Commands

The Set commands are for the user to set the BT-1022 configuration.

| SET Commands | Command Set | Conditions & Notes |
|---|---|---|
| **Set inquiry scan and page scan mode command** | **AT + SSM = scanMode \r** | **scanMode:**<br>0 : hci_scan_enable_off<br>1 : hci_scan_enable_inq<br>2 : hci_scan_enable_page<br>3 : hci_scan_enable_inq_and_page |
| **Set pin code command** | **AT + PIN = pinCode \r** | **pinCode:**<br>default: 0000<br>4< pincode length <16 |
| **Set local name command** | **AT + SLN = localName \r** | 1 <= local name length <= 16 |

| | | |
|---|---|---|
| **Set Baud rate command** | **AT + SBR = baudRate \r** | **baudRate:**<br>UART Baud rate<br>=baudRate/0.004096<br>Some common values are:<br>9k6 baud - 39<br>19k2 baud - 79<br>38k4 baud - 157<br>57k6 baud - 236<br>115k2 baud - 472<br>230k4 baud - 944<br>460k8 baud - 1887<br>921k6 baud - 3775<br>1382k4 baud - 5662 |
| **Set class of device command** | **AT + SCOD = classOfDevice \r** | **classOfDevice:**<br>6 hexadecimal class of device |
| **Set security mode command** | **AT + SSCM = securityMode \r** | **securityMode:**<br>0 : security_off, encyption_off<br>1 : security_on, encyption_off<br>2 : security_on, encyption_on |
| **Delete all authorized devices command** | **AT + DA \r** | |

## 3.1.7. Get Commands

| GET Commands | Command Set | Conditions & Notes |
|---|---|---|
| **Get inquiry scan and page scan mode command** | **AT + GSM \r** | |
| **Get local name command** | **AT + GLN \r** | |
| **Get class of device command** | **AT + GCOD \r** | |
| **Get local address command** | **AT + GLA \r** | |
| **Get security mode command** | **AT + GSCM \r** | |
| **Get remote name command** | **AT + GRN = address \r** | **address:**<br>12 hexadecimal Bluetooth Device Address |
| **Get state command** | **AT + STA \r** | |

| | | |
|---|---|---|
| **Get operation mode command** | **AT + GOM \r** | |

### 3.1.8. Action Commands

The actions commands are for the users to control the BT-1022 to do certain actions. The defined actions are: Inquiry, Connect, Reset and Search SPP profile.

| ACTION Commands | Command Set | Conditions & Notes |
|---|---|---|
| **Inquiry command** | **AT + INQ = classOfDevice, maxResponses, timeout \r** | **classOfDevice:** 6 hexadecimal class of device filter set 000000 -- notified of all devices within range regardless of their class of device. audio/ video to be 000400 ; headset to be 200404 **maxResponses:** 1 <= maxResponses <= 10 **timeout:** 1(1.28 seconds) <= timeout <= 48(61.44 seconds) |
| **Connect command** | **AT + D = address \r** | **address:** 12 hexadecimal Bluetooth Device Address |
| **Reset command** | **AT + RST \r** | |
| **Search SPP profile command** | **AT + SSPP = address \r** | **address:** 12 hexadecimal Bluetooth Device Address |

### 3.1.9. Default Setting

The following sections describe the default settings when BT-1022 module is out of Atech factory.

#### 3.1.9.1. Bluetooth Setting

Mode: Master

Profile: SPP

Local Name: BT SPP

PIN CODE: “1234”

Discoverable mode (Pairing Mode) will continue without time-out following VCC 3.3V input.

#### 3.1.9.2. UART Setting

Baudrate: 9600

Flow control: No flow control

## 3.2. Usage – SPP (Serial Port Profile)

### 3.2.1. Pin Definition and Software Configuration

| **Local Name** | BT SPP + LAP (read by USB dongle) | **Baudrate** | Configurable (1200 ~ 115200 bps) |
|---|---|---|---|
| **PIN code** | 1234 | | |

| **Pin** | **Config** | **Function** | **Spec** |
|---|---|---|---|
| **PIO 0** | (Out) | Internal Used | |
| **PIO 1** | (Out) | Internal Used | |
| **PIO 2** | (In) | Baud Rate Switch 1 / UART Configuration Switch 1 | Described below |
| **PIO 3** | (In) | Baud Rate Switch 2 / UART Configuration Switch 2 | Described below |
| **PIO 4** | (In) | Baud Rate Switch 3 / UART Configuration Switch 3 | Described below |
| **PIO 5** | (In) | Hardware Flow Control Switch / DTE-DCE Switch | Described below |
| **PIO 6** | (Out) | LED | Described below |
| **PIO 7** | (In) | Reset Button | Described below |
| **PIO 8** | (In/Out) | DTR | Output in DTE / Input in DCE |
| **PIO 9** | (In/Out) | DSR | Input in DTE / Output in DCE |
| **PIO 10** | (In/Out) | DCD | Input in DTE / Output in DCE |
| **PIO 11** | (In/Out) | RI | Input in DTE / Output in DCE |
| **AIO A** | (NA) | | |
| **AIO B** | (NA) | | |

**#If Reset Button (PIO7) was pressed (high) while power on reset, app would be in configuration mode.**
**If Reset Button (PIO7) was opened (low) while power on reset, app would be in operation mode.**

**#In configuration mode, PIO2 ~ PIO5 serves as configuration switches.**
**PIO2: low => one stop bit, high => two stop bits.**
**PIO3: low => no parity bits, high => one parity bit.**
**PIO4: low => odd parity, high => even parity.**
**PIO5: low => DTE, high => DCE.**
**When the configuration is saved in PS keys, PIO6 (LED) will be always on.**

**#In operation mode, PIO2 ~ PIO4 serves as Baud Rate switches.**
**PIO4 / PIO3 / PIO2 : Baud Rate**
**000 : 115200**
**001 : 57600**

**010 : 38400**
**011 : 19200**
**100 : 9600**
**101 : 4800**
**110 : 2400**
**111 : 1200**

**#In operation mode, PIO5 switches hardware flow control on (high) / off (low).**

**#In operation mode, LED (PIO6) blinks once per second in discoverable mode and blinks twice every two seconds if connected.**

**#In operation mode, Reset Button (PIO7) can be used (pressed) to disconnect from peer device and return to be discoverable.**

### 3.2.2. Default Setting

The following sections describe the default settings of BT-1022 module for BT-1022 module with Atech SPP firmware. All unused PIO pins

#### 3.2.2.1.Bluetooth Setting

Mode: Master
Profile: SPP
Local Name: BT SPP + LAP
PIN CODE: “1234”
Discoverable mode (Pairing Mode) will continue without time-out following VCC 3.3V input.

#### 3.2.2.2.UART Setting

Baud Rate: 115200bps
Data Bits: 8
Parity: No parity
Stop Bits: 1